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the summit of Mount Dandi he has found a double lake of considerable extent and depth, shaped like the figure eight. An affluent of the Gudar issues from this lake. He also discovered a deep lake, with most beautiful surroundings, at the foot of the immense crater mountain called Mt. Harro. A stream from this Lake Wancit joins the Walga, which rises on the summit of the mountain.

According to the Consular Report for 1887, the population of Java and Madura in 1886 was 21,997,259, showing an increase of 1,065,605 since 1884. The exports of cinchona are increasing.

Late measurements of the heights of the Austrian Alps have reduced the Marmolata, the highest dolomite, from 11,464 feet to 11,016 feet, have shown the Antelao to have 10,874 feet, and place the Cima di Vezzana at 10,470, and the Cima della Pala at 10,454. The former of these peaks must therefore be regarded as the loftiest of the Primiero group, the remaining peaks of which gain or lose only a few feet by the new survey.

GEOLOGY AND PALÆONTOLOGY.

OSBORN ON THE MESOZOIC MAMMALIA.¹—In this essay we have a comprehensive and minute study of the Mesozoic Mammalia, based on the existing collections of the world. First among the latter is that of the British Museum; then that of Yale College; then those of Prof. Cope, of the Philadelphia Academy and of William's College, Mass. The results obtained are of the greatest interest and importance to the question of the origin of the Mammalia. Professor Osborn has undoubtedly given the only analysis of the dental characteristics of these types, which we have; and as a consequence we can form a much better idea of their systematic and phylogenetic relations than has been hitherto possible. The results of the research are summarized as follows: First, Traces of Reptilian structure are only observable in the Triassic genera *Dromotherium* and *Microconodon*, which Prof. Osborn accordingly places in a new order, the *Protodonta*. Second, The close parallelism of the American and European genera, and of species of the latter country and South Africa. Third, The diversity of the dental types of the genera, and the specialization of some of them. There are six or seven wholly distinct types of dentition.

¹ The Structure and Classification of the Mesozoic Mammalia. By Prof. H. F. Osborn. From the Journal Academy Natural Sciences of Philadelphia. [2] Vol. IX., pp. 186-265. July, 1888.

Professor Osborn regards the Multituberculata as a distinct series, and considers their reference to the Monotremata to be an open question. Of the remaining types he refers a part to the Marsupialia, under the name Prodidelphia (Hæckel), and the position of the remainder he leaves in doubt, placing them provisionally in the Insectivora. The dental characters of the Multituberculata are tolerably uniform, but the case is different with the two other divisions. In the Prodidelphia there is a carnivorous and omnivorous subgroup, with three well-defined families; and a herbivorous subgroup, including only the remarkable family Kurtodontidæ, based on the single genus Kurtodon, which was discovered by the author himself. Of the possible Insectivora there are two families. The families proposed appear to be well defined.

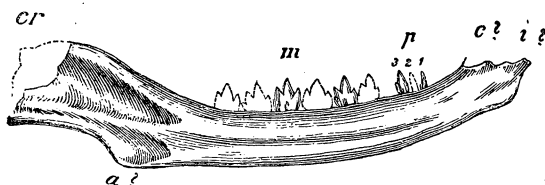
In analyzing the dental characters, Prof. Osborn follows the lines laid down by the author of the present review. He also finds the phylogenetic deductions made by the same author to be sustained by his investigation. Between the simply conic (haplodont) and the complex crown (lophodont) he finds the series to be triconodont, tritubercular, tuberculo-sectorial (lower), and quadritubercular. He confirms the view that the tritubercular has been produced by the rotation outward, in the upper jaw, and inward in the lower jaw of the anterior and posterior cusps of the triconodont crown. Prof. Osborn names the principal cusp the "protocone," and the anterior and posterior cusps "paracone" and "metacone," respectively. Among Mesozoic Mammalia we have the first three of the above types represented, together with a half-prismatic type in Kurtodon Osb., besides the Multituberculata.

This memoir was long in press, and has grown by a process of accretion; hence there appear some unavoidable irregularities of classification of its contents. A foot-note we observe is liable to misconstruction (p. 245), where it states that Dr. Harrison Allen first demonstrated the modification of the tritubercular into the quadritubercular molar crown. Dr. Allen demonstrated the possibility of this history by an acute study of the homologies of the cusps, but he did not demonstrate it ontogenetically or phylogenetically. We have but one serious criticism to make of this memoir. This is the almost universal introduction of specific characters into diagnoses of genera. Examples of this are seen on p. 216, where all the characters in the generic diagnoses except one or two are only specific.

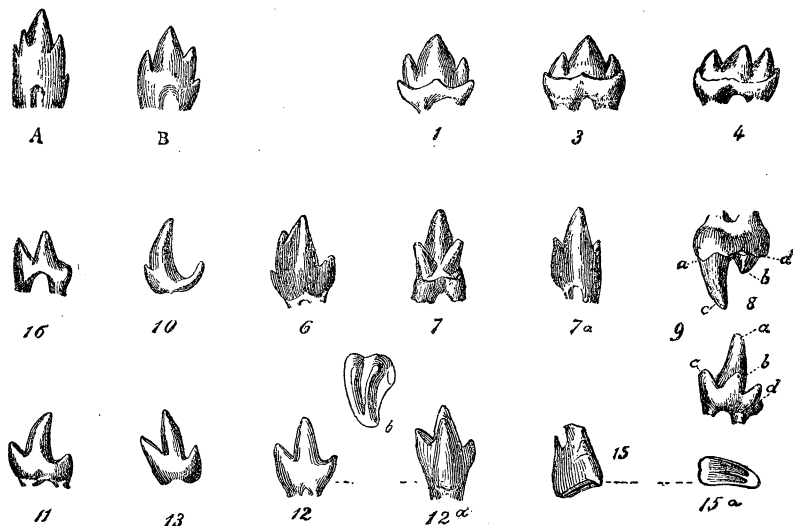
This memoir is illustrated by numerous excellent cuts, and by two plates. Two of the cuts are here reproduced.—*E. D. Cope.*

LYDEKKER ON THE ICHTHYOSAURIA AND PLESIOSAURIA.—In two late numbers of the *Geological Magazine* of London, Mr. Lydekker publishes reviews of the English species of the two

PLATE XIV.



A



B

FIG. A.—*Microconodon tenuirostris* Osborn; outer face of right mandibular ramus, four times natural size.

FIG. B.—Principal molar tooth-forms of the Mesozoic Mammals of the second Group. The anterior face of the molars throughout is to the left, and the posterior face to the right. A, *Dromotherium*, second inferior molar, inner face, $\times 7$. B, *Microconodon*, the fourth lower molar, outer face, $\times 7$. 1, *Amphilestes*, the second lower molar, inner face. 3, *Phascolotherium*, the fifth lower molar, inner face. 4, *Triconodon*, the second lower molar, inner face. 6, *Peramus*, the fourth lower molar, outer face. 7, *Spalacotherium*, third lower molar, inner face. 10, *Leptocladus*, third lower molar, outer face. 11, *Phascolestes*, third lower molar, inner face. 13, *Achyrodon*, fourth lower molar, outer face. 12, *Dryolestes*, lower molar, inner face; a, outer face; b, wearing surface. 15, *Kurtodon*, upper molar; a, wearing surface.

orders above named, which will be of much use to students. He admits three genera of Ichthyosauria, viz.: *Ophthalmosaurus* Seeley (*Baptanodon* Marsh), *Ichthyosaurus* Conyb, and *Mixosaurus* Baur. He does not find any reason to subdivide the genus *Ichthyosaurus*. Of Plesiosauridæ he admits the genera *Plesiosaurus*, *Thaumatosaurus*, *Pliosaurus*, and *Elasmosaurus* (under the name *Cimoliasaurus*), but does not include in the last named the Jurassic species which have the same structure of the shoulder-girdle, which Seeley described under the name of *Colymbosaurus* several years ago. We find this course inconsistent, and believe the principles adopted by Seeley in his classification of the Plesiosauridæ to be well founded, except as to the genus *Muraenosaurus*, which Mr. Lydekker shows to be a synonym of *Colymbosaurus*. Mr. Lydekker falls into the error of supposing that the genus *Polycotylus* is principally characterized by the cupping of the vertebræ. The fact is, that the structure of the paddles is as different from that of *Plesiosaurus*, as that of *Ichthyosaurus* is from *Mixosaurus*, and in much the same way.

Mr. Lydekker in one of these papers formulates his reasons for his habitual inconsistency in the matter of taxonomy, by saying that in his opinion generic discriminations are "simply a matter of convenience." We hold a different view, in common, as we believe, with most taxonomists, which we have stated elsewhere. We will content ourselves now with observing that we find the method of Mr. Lydekker a matter of *inconvenience* rather than of convenience. We must also once more protest against being misquoted by Mr. Lydekker. He says (*Geol. Magazine*, Aug., 1888, p. 356), "We may notice Professor Cope's restoration of the so-called *Elasmosaurus platyurus*, given in the *Transac. Amer. Philos. Soc.*, Vol. XIV., pt. i., pl. ii. In this instance the head has been placed at the extremity of the tail," etc., etc. On this I must observe that no such plate appears in the *Transactions of the American Philosophical Society*, or in those of any other Society. Of this Mr. Lydekker can easily satisfy himself. It is true, however, that an error got into the first descriptions of that species (see *Proceed. Boston Society Nat. History*, 1869-70), but it was done in imitation of the precedent laid down by the describer of the species named *Cimoliasaurus* (a name which Mr. Lydekker wishes to adopt) several years earlier. Here the cervical vertebræ were described as caudals. This mistake was corrected by its author after an inspection of the skeleton of *Elasmosaurus*. The plates and descriptions published by the American Philosophical Society are also correct, and the genus *Elasmosaurus* is there for the first time fully characterized. The supposed genus *Cimoliasaurus* was never characterized by the author of the name.

We suspect that if we were to state that Mr. Lydekker had described the bones of a crocodile as those of an ostrich, and the teeth of a baboon as those of an ape, without at the same time stating that he had himself corrected those errors, he would not consider our method of criticism legitimate.¹ And if we were to assert that in description he called the inside the outside, when he had not done so,² and stated that a scientific body had published a plate which it did not publish, he would consider us wanting in a primary essential of criticism, viz., accuracy.—*E. D. Cope.*

BIBLIOGRAPHICAL NOTES ON THE TWO BOOKS OF CONRAD ON TERTIARY SHELLS.—Having had occasion to see various copies of T. A. Conrad's "Fossil Shells of the Tertiary Formations" and "Fossils of the Tertiary Formations," I have found that nearly all of them in some respects are deficient. In fact, I have not seen a single copy that gives perfectly all that has been published in the way in which it had been issued, and one finds in the literature quite a number of assertions which show an erroneous or imperfect knowledge of these two works.¹ For this reason I consider it desirable to give the following notes:—

1. "Fossil Shells of the Tertiary Formations of North America." The two most complete copies which I have seen are those in the library of the Academy of Natural Sciences and my own. Neither is perfectly complete, but both together furnish the following data:—

The book has been issued in two editions, the second edition being a supplement to the first one. The first edition has been issued in four parts.

First edition: Part I. Pages 1 to 20, plates 1 to 6. Yellow cover, with date October 1, 1832. There is nothing printed on the back of this cover.

Part. II. Pages 21 to 28, plates 7 to 14. Yellow cover, with the date December, 1832; a note by the author on its fourth page.

¹ American Naturalist, 1888, p. 165.

² We suggest whether Mr. Lydekker has not referred, in the addendum to the V. Vol. Catal. Fossil Mammalia Brit. Mus., a species of Tragulidæ to the Bovidæ and to the genus Tetracerus. We did not allude to this in our review of this volume, thinking the author would correct it himself.

¹ For instance, owing to a deficiency of his copy of the "Fossils of the Tertiary," Professor A. Heilprin says: "Fulgur maximus Conrad, Fossils of the Medial Tertiary Formations, plate 47, not described." (Explorations on the West Coast of Florida, p. 72.) Conrad, however, described this species twice, first on the cover of the second part, then on page 83. Compare also the statements in White's Bibliography of North American Invertebrate Palæontology.

Part III. Pages 29 to 38, plates are mentioned in the text, but none have been published. Yellow cover, with the date August, 1833; on the fourth page there is a note that the plates will be published with No. 4.

Part IV. Pages 39 to 46. No plates. Yellow cover, with date October, 1833; on the fourth page a note signed, "T. A. Conrad, Claiborne, Alabama, November 1, 1833." Second edition: Pages numbered 29 to 56, plates numbered 15 to 18. One colored geological map of Alabama. Blue cover, the title-page of which gives the date: "Republished with plates, March 1, 1835."

2. "Fossils of the Tertiary Formations of the United States." The book is sometimes quoted as "Fossils of the Medial Tertiary of the United States," on account of the title-page of two of its parts. The following notes are also based on the copy in the library of the Academy of Natural Sciences and my own copy, which supplement each other.

The introduction is numbered V. to XVI.; the rest is numbered 1 to 89. There are forty-nine plates; some of them are without a number. The book has been issued apparently in three parts. The cover of the second part contains quite a number of descriptions.

Part I. Pages 1 to 32, plates 1 to 17. The brown cover is without a date, and gives the title: "Fossils of the Medial Tertiary of the United States." The fourth page contains the descriptions of four species.

Part II. Page 33 to 56, plates 18 to 29. The brown cover is also without a date, and on the title-page is also printed, "Fossils of the Medial Tertiary," etc. The other three pages contain quite a number of descriptions, among them the same four species, which are described on the cover of Part I.

Part III. Contains apparently the rest of the book; pages 57 to 89, plates 30 to 49. The brown cover is also without date, but gives the title: "Fossils of the Miocene Formation of the United States."

Regarding the date of issue of the different parts of the "Fossil Shells," and the authorship of Part III. and Part IV., nothing need be said here. Regarding the date of issue of the "Tertiary Fossils," the following may be stated:—

The cover of Part I. of the Academy's copy bears in Conrad's handwriting the date "January, 1838."

The cover of Part II. of my copy is marked with ink in Conrad's handwriting, "May 7, 1840."

The cover of Part III. of my copy is marked in the same way by Conrad, "January 1845."—*Otto Meyer, Ph.D.*

CHALICOTHERIUM AND MACROTHERIUM.—M. Henri Filhol has recently made a discovery of remarkable interest in the beds of Sansan, of the middle Miocene of France. It removes, in the first place, what has long been an enigma, that in three separate miocene deposits, those of Sansan, Eppelsheim and Pikermi, the limbs of one genus are very numerous with no trace of the skull, while the skulls of another genus of about the same size have never been found with the limbs. The discovery that Chalicotherium represents the skull of the long-known skeleton of Macrotherium, the one a supposed ungulate, the other a supposed edentate, is so astonishing that one can hardly credit it at first. M. Filhol himself, however, found the skeleton, which is almost complete, with the skull *in situ*, so that there remains little or no doubt that they belong together, and he now has an extensive memoir in preparation giving the complete characters of the animal. The peculiarity of *Macrotherium* and the more recent *Ancylotherium* is the deep grooving of the terminal phalanges as in the sloths. This, taken with the modification of the middle phalanges and the rotation of the fore and hind feet upon the outer side, with the shortening of the inner toes, is so strikingly edentate, that attention has been entirely drawn away from the upper bones of the hand and foot. When, however, one examines the carpus and tarsus, with the perissodactyl affinities of the molar teeth in mind, it immediately appears that this is a well-marked perissodactylic type, closely resembling that of *Palæosyops*, in the tarsus, especially. After an examination of the feet in the collection of the Jardin des Plantes, no doubt remained in my mind of the association of Chalicotherium and Macrotherium. Without anticipating M. Filhol's memoir I may note a few of the Perissodactyle characters of the tarsus. The calcaneum has a long neck and broad internal extension, which is lacking in the edentates, for articulation with the astragalus. The latter bone is much like that of some species of *Aphelops* with the neck very short; it has a broad facet for the cuboid. The cuboid has a postero-internal extension which is also found in *Palæosyops*. The cuneiform is very highly modified, being reduced anteriorly to a thin shell. The third metatarsal abuts against the cuboid, the second against the external cuneiform. In short, remove the phalanges, widen the navicular, and lengthen the middle instead of the second metatarsal and you have a true Perissodactyle tarsus. The carpus is equally so, but is much less characteristic. Turning to the skull, we find of course the teeth of the *Palæosyops* type. I think there is an alisphenoid canal. There are other non-perissodactyle characters; there is no third trochanter of the femur, and, as M. Filhol points out the arrangement of the skull is very different. The tympanic bones are also largely developed and of a unique shape. The question remains, what is this animal?

M. Filhol's restoration showing the long fore limbs and short hind limbs, and feet resting partly on the side, demonstrates that it had the habits of the sloths. He also informs me that the older individuals retain only one incisor. On the other hand the structure of the carpus, tarsus, skull and teeth, is in so many features so strikingly *Perissodactyl*, that there seems to be no alternative except to leave *Chalicotherium* in this order and regard it as an aberrant form, with nearest affinities to *Palæosyops* and genera of that line.—*Henry F. Osborn, Paris, September 1st.*

GEOLOGICAL NEWS.—GENERAL.—Mr. Mellard Reade and Mr. Davison have recently pointed out that, owing to the cooling and contraction of the earth, there is at some depth beneath the surface a zone of no stress, that is to say, where the compressive stress due to the radial contraction of the sphere, and the tensile stress due to the circumferential contraction of each zone, are equal. Prof. C. L. Morgan (*Geol. Mag.*, 1888, p. 296) asks, "Is it not possible that throughout the zone of maximum tension, due to circumferential contraction, the rocks may be rendered fluid by relief of pressure?" With regard to mathematical calculations upon the depth of this viscous or fluid zone beneath the surface, Prof. Morgan truly remarks that "numerical calculations in these matters are only too apt to mislead by throwing a glamour of apparent mathematical accuracy over problems concerning which the most noteworthy feature is our profound ignorance."

CAMBRIAN AND SILURIAN.—The Palæontological Department of the Swedish State Museum has published a list of the Cambrian and Lower Silurian faunas of that country, by Prof. G. Lindström, and another of the Mesozoic fauna, by Prof. B. Lundgren. The Cambrian is divided into (1) the Eophyton and Fucoid Sandstones, (2) the Paradoxides beds, (3) the Olenus Schists, and (4) the Dictyonema Slate. One hundred and fourteen species are enumerated from this formation. The Lower Silurian comprises 1, Ceratopyge Limestone; 2, Lower Graptolite Schists; 3, Orthoceratite Limestone; 4, Middle Graptolite Schists; 5, Chasmops Limestone; 6, Trinucleus Schists; 7, Brachiopod Schists; 8, Upper Graptolite Schists; and 9x9, Leptæna Limestone. The species enumerated from the Lower Silurian number 627.

CARBONIFEROUS.—It appears that the peculiar rock called chert consists mainly of the spicules of sponges. Dr. G. J. Hinde has found it to be thus composed in the Yoredale series of Yorkshire (Eng.), in Wales and in Ireland, while in the June issue of the *Geological Magazine* he describes the character of the sponges of the chert and siliceous schists of Spitzbergen. The Permo-Carbonifer-

ous series of the west and southwest shores of Spitzbergen is over 200 m. in thickness, and is divided by Dr. Nathorst into the Ursa Sandstone, regarded as Devonian, the Cyathophyllum Limestone, the Spirifer Limestone, and the Productus Chert. This series is not followed by grits, sandstones, and coal-measures, but by shales, marls, and sandstones containing an exclusively Permian fauna, and the series itself, though as a whole regarded as stratigraphically equivalent to the Carboniferous Limestone, contains a certain mixture of Permian fossils. The Productus-chert consists of beds of chert composed largely of disintegrated siliceous sponges, but rich also in Producti and other calcareous fossils, and of intercalated siliceous beds consisting of minute grains of quartz, but rich in sponge spicules. The cherty rocks, unlike those of Yorkshire and North Wales, have yielded entire forms of sponges, which have been described by Dr. E. von Dunikowski.

Dr. R. H. Traquair (*Geol. Mag.*, 1888, pp. 251-254) describes three new species of Palæoniscidæ from the English Coal-Measures. The article is the second contribution from Dr. Traquair upon this subject, the first being contained in the December issue of the same magazine for the year 1886.

In the July issue of the *Geological Magazine* Mr. A. C. Seward comes to the support of Prof. Williamson's remark that the specific names and definitions of Calamites are probably worthless, with a figure and description of a specimen which upon one side shows the characters of *C. undulatus*, while the other side of the same cylinder has narrow and equal ribs.

Dr. Schweinfurth has discovered Lower Carboniferous beds in the Arabah valley of Upper Egypt, opening out into the Gulf of Suez. He recognizes the identity of the beds he describes with those of the Wadi Nasb in the Sinaitic Peninsula; the genera are in most cases identical, and the species characteristically Carboniferous.

MESOZOIC.—Of the lower portions of the Mesozoic series only the Rhaetic and Liassic strata are developed in Sweden, and not more than twenty-four species are enumerated by Prof. Lundgren from the former and 129 from the latter group. There is then a wide gap in the middle portion of the Mesozoic, until the higher members of the Cretaceous are reached. These are highly fossiliferous, the list comprising 456 species.

JURASSIC.—Mr. R. Lydekker (*Geol. Mag.*, 1888, p. 309) restricts the genera of Ichthyopterygia to three, viz.: Ophthalmosaurus, Ichthyosaurus, and Mixosaurus, the last the least specialized. *I*

tenuirostris and its allies are the forms most nearly allied to *Mixosaurus* Baur, and *I. tenuirostris* has only four digits. From this Mr. Lydekker agrees with Dr. Baur that the Ichthyosaurs have descended from a tetradactylate ancestor. Two additional species, *O. cantabrigensis* and *I. conybeari*, are described, the former from the Greensand of Cambridge (Eng.), the latter from the Lower Lias.

“The Insect-world of the Lithographic Shales of Bavaria” is the title of an extended article in Volume 34 of *Palæontographica*, by P. Oppenheim. Among the fossils described are *Cyrtophyllites rogeri*, a new genus and species of Locustidæ, two new species of Ephemera, *Prolystra lithographica*, *Euicada microcephala*, *Ischyopteron suprajureense*, n. gen. et sp.; Halometra, a new genus of Hydrometridæ, with two species; three species of Carabidæ, a Prodytiscus, two forms of Lamellicornia, two of Clavicornia, three of Sternoxia, one of Rhynchophora, and three of Chrysomelidæ.

CRETACEOUS.—A. S. Woodward (*P. Z. S.*, X. Feb. 21, 1888) shows that the lateral line of *Scyllium schelalmæ*, from the chalk of Mt. Lebanon, was supported by a series of half-rings, exactly like those met with in *Squaloraja* and the Chimæroids. The canal of the lateral line was thus presumably an open groove; a condition which obtains in only two living Selachians, *Echinorhinus* and *Chlamydoselachus*.

Squatina cranei is the name given by Mr. S. Woodward to a species of “angel-fish” discovered in the chalk of England, and distinguishable from the species of *Squatina* already satisfactorily known by the great relative size of the spinous dermal tubercles. No defences of this kind have been found in extinct forms, and the existing species has them much smaller in proportion to the size of the fish.

The same geologist also describes certain specimens of mandibles of the singular *Belonostomus cinctus*, revealing the precise character of the dentition, and the relations of the bones. The two rami occupy only half the entire length of the jaw, the anterior half being formed by the enormously elongated pre-symphysial bone. The narrow and deep rami meet at a very acute angle; the symphysis is elongate, gradually diminishing to a thin edge below, and the large pre-symphysial bone, which is a median unpaired element is articulated to the sloping triangular surface thus formed. On the latter bone there is a median row of about thirty large conical teeth, while a great number of smaller similar teeth—the largest little more than one-sixth the height of the largest of the median series—are placed irregularly upon the lateral margins of the bone.